ESA-034-2 United States Steel Corporation - Midwest Plant – Portage, IN
Final Public Report

Introduction:

Founded in 1901, United States Steel Corporation, headquartered in Pittsburgh, Pa., manufactures a wide variety of steel sheet, tubular and tin products; coke, and taconite pellets; and has a worldwide annual raw steel capability of 26.8 million net tons. U. S. Steel's domestic primary steel operations are: Gary Works in Gary, Ind.; Great Lakes Works in Ecorse and River Rouge, Mich.; Mon Valley Works, which includes the Clairton, Edgar Thomson and Irvin Plants, near Pittsburgh, Pa. and Fairless Plant near Philadelphia, Pa.; Granite City Works in Granite City, Ill.; Fairfield Works near Birmingham, Ala.; Midwest Plant in Portage, Ind.; and East Chicago Tin in East Chicago, Ind. The company also operates two seamless tubular mills, Lorain Tubular Operations in Lorain, Ohio; and Fairfield Tubular Operations near Birmingham, Ala. U. S. Steel remains the largest integrated steel producer in the United States.

The ESA occurred at the Midwest Plant in Portage, Indiana. The furnace analyzed is used to continuously anneal sheet steel that is ultimately tin coated and used primarily for the manufacture of containers.

Objective of ESA:

The objective of the ESA was three fold:

1. Introduce the PHAST program to plant personnel.
2. Train plant personnel on the use of the PHAST program by applying it to a real world application. During this phase access the strengths and weakness of the analysis and develop methods to ensure and accurate outcome.
3. Facilitate a discussion of fuel savings opportunities among the participants.
4. Identify and quantify specific energy savings opportunities. Estimate required resources. Focus on projects that wall within the corporate payback targets.

Focus of Assessment:

ESA examined the thermal performance of the vertical continuous annealing furnace. Areas analyzed included work flow, heat containment and burner efficiency. A summary of the natural gas and purchased electricity for base year 2006 is provided below:

- Natural Gas
  - 5,970,092 MMBtu/yr
- Electricity
  - 99,967,000 kWh/yr

Approach for ESA:

Working with plant personnel, the agenda was altered to obtain the most valuable outcome. In brief, the process went as follows:

Discussed the overall process and provide plant personnel time to determine the best target(s) for the analysis. This discussion included:

A. The ESA and Save Energy Now program
B. Program and Plant expectations
C. A preliminary discussion of required steps.

1. Target Equipment Identification
   - Identify which process heating device(s) will be used for the assessment. Suggested criteria includes:
     A. The equipment type should represent a significant use of energy.

B. There should be a means to collect operating data from the equipment that will be entered into the PHAST program for analysis.
C. Participants should suspect the machine represents significant energy savings opportunities.

2. The Group decided to examine the performance of the heating section of the continuous annealing furnace.

3. Review Heat Supply and Demand (Sankey Diagram)

4. Review the PHAST program – illustrating what data would need to be collected

5. Discuss data collection techniques and tools. Basic Tool list includes (As provided by ESA Specialist):
1. Combustion analyzer to measure O2 and CO. Various probes and conditioning equipment for sampling.
2. Pressure measuring devices
3. Temperature measuring devices

6. Collected Basic Information for entry into the PHAST program. This included work flow rates and specific heats, combustion ratios, flow rates to burners, combustion air temperature, burner exhaust temperatures, furnace dimensions, surface temperature, and potential hole losses.

7. Created a spreadsheet to summarize burner information using weighted averages for flow, percent on time, exhaust and ratio for input into the PHAST program.

8. Reviewed existing energy consumption and production data. Discussed accuracy and repeatability of this data.

9. Entered data into PHAST program. The group was comfortable that we had a conservative model of the furnace in question.

10. Discussed ongoing projects aimed at improving furnace energy efficiency per ton of steel produced.

11. Perform "what if" analysis for various energy savings opportunities. Specifically, reduced excess O2 settings through stabilization of both the air and fuel gas pressures.

12. Discuss / Estimate expected capital / implementation costs for "what if" opportunities. Completed a spreadsheet illustrating the expected paybacks.

13. Presented our finding to plant management personnel. The group was very supportive of the conclusions of the ESA participants.

General Observations of Potential Opportunities:

Total Plant Natural Gas Usage – 6,222,225 mmBtu

Near Term opportunities: **Near Term Savings 82,080 mmBtu or 1.3 % of total plant natural gas consumption**

1. Install new fuel gas valves and pressure transducers.
2. Re-adjust and Balance air and fuel gas flows to achieve approximately 2% excess oxygen in the flue products.
3. Repair burner components as required.

   For steps 1 – 3 above, the fuel savings will be approximately 38,880 mmBTU / year. The fuel cost savings for the above was calculated to be $ 299,376. Expected cost for the above initiative will be approximately $ 99,600. The simple payback period will be 0.33 years.

4. Install a variable frequency drive in the exhaust fan to ensure constant draft is delivered to the zone fuel valves.
5. Install new zone flue valves and pressure transducers to accurately regulate combustion air flow to the burners.

6. Re-adjust and Balance air and fuel gas flows to achieve approximately 2% excess oxygen in the flue products.

   For steps 4 – 6 above, the fuel savings will be approximately 43,200 mmBTU / year. The fuel cost savings for the above was calculated to be $ 332,640. Expected cost for the above initiative will be approximately $ 287,560. The simple payback period will be 0.86 years.

Management Support and Comments:

The projects meets the Corporate guideline for rate of return and therefore have a very good chance of being funded and executed.

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